

WHAT IS CLAIMED IS:

1. A probe card assembly comprising:  
probe elements; and  
a package coupled to the probe elements, wherein the package includes at least one die with active electronic components and at least one coolant port that allows a coolant to enter the package and directly cool the active electronic components of each die during a testing operation.
2. The probe card assembly of claim 1, wherein the at least one coolant port allows liquid coolant to enter and exit the package.
3. The probe card assembly of claim 1, wherein the at least one coolant port allows gas coolant to enter and exit the package.
4. The probe card assembly of claim 1, wherein the at least one coolant port allows a combination of liquid and gas coolants to enter and exit the package.
5. The probe card assembly of claim 1, further comprising:  
a cooling system; and  
a coolant circulation system coupled between the cooling system and the at least one coolant port.
6. The probe card assembly of claim 1, wherein the package includes a bottom substrate and a top substrate coupled to one another by a seal to form a cavity.
7. The probe card assembly of claim 6, wherein the seal comprises an O-ring.

8. The probe card assembly of claim 1, wherein the probe elements are directly connected to the package.

9. The probe card assembly of claim 1, wherein the package includes a chamber and a bottom substrate coupled to form a cavity, and each die with active electronic components is coupled to the bottom substrate within the cavity such that the active electronic components face the bottom substrate.

10. The probe card assembly of claim 1, wherein the package further includes a bottom substrate and compliant interconnects, the compliant interconnects being coupled between each die and the bottom substrate.

11. The probe card assembly of claim 10, said compliant interconnects comprise spring contacts.

12. The probe card assembly of claim 11, said spring contacts comprise wirebond springs.

13. The probe card assembly of claim 11, said spring contacts comprise lithographic springs.

14. The probe card assembly of claim 1, wherein the package further includes a bottom substrate, a top substrate, first and second sets of compliant interconnects, and alignment posts, wherein the alignment posts are attached to the bottom substrate, the first set of compliant interconnects is coupled between each die and the bottom substrate, and the second set of compliant interconnects is coupled between each die and the top substrate, and wherein the dies are held in place by frictional contact with the alignment posts, by direct contact between the first set of compliant interconnects and each die, and by downward pressure from the second sets of compliant interconnects on each die.

15. The probe card assembly of claim 1, wherein the package further includes a bottom substrate having output contacts arranged on an edge region of the bottom substrate, whereby external components can be electrically coupled to each die via the output contacts.

16. The probe card assembly of claim 1, wherein the package further includes a top substrate with a top surface representing an exterior surface of the package and wherein the top surface includes output contacts, whereby external components can be electrically coupled to the each die via the output contacts.

17. The probe card assembly of claim 1, wherein the package further includes a top substrate and a bottom substrate and interconnection elements that provide electrical paths extending through a cavity between the top substrate and the bottom substrate.

18. The probe card assembly of claim 1, wherein said at least one die comprises a plurality of dies.

19. The probe card assembly of claim 18, wherein said plurality of dies are arranged compactly within the package.

20. The probe card assembly of claim 1, wherein the package further includes at least one of an interposer and a printed circuit board such that said coolant further directly cools said at least one of an interposer and printed circuit board during a testing operation.

21. The probe card assembly of claim 1, further comprising at least one non-contacting compliant interconnect coupled to a surface of said at least one die, whereby, heat can be further directed away from the surface of a die.

22. The probe card assembly of claim 1, wherein said package further comprises:  
a top substrate; and  
a bottom substrate; wherein each die is flip-chip bonded to said top substrate.
23. A method for incorporating active electronic components near probe elements, comprising:  
sealing at least one die with active electronic components in a package;  
coupling the package to probe elements; and  
circulating coolant through the package during operation of the active electronic components in testing to reduce thermal variations across each die.
24. A probe card assembly comprising:  
a cooled package; and  
a coolant circulation system that carries circulating coolant to and from said cooled package;  
wherein the cooled package comprises at least one die coupled through compliant interconnects to the cooled package, and  
wherein the at least one die has active electronic components that emit heat during a testing operation and the heat is transferred by the circulating coolant away from the active electronic components of each die during the testing operation.
25. The probe card cooling assembly of claim 24, wherein said compliant interconnects comprise spring contacts.
26. The probe card cooling assembly of claim 25, wherein said spring contacts comprise wirebond springs.

27. The probe card cooling assembly of claim 25, wherein said spring contacts comprise lithographic springs.

28. A probe card cooling assembly comprising:

probe elements;

a cooling member;

a cooled package coupled to said probe elements and filled with coolant, the cooled package further including at least one die immersed in the coolant during a testing operation; and

one or more heat radiators that transfer heat generated by the at least one die from the coolant to said cooling member.

29. The probe card cooling assembly of claim 28, wherein each die is coupled through compliant interconnects to the cooled package.

30. The probe card cooling assembly of claim 29, wherein said compliant interconnects comprise spring contacts.

31. The probe card cooling assembly of claim 30, wherein said spring contacts comprise wirebond springs.

32. The probe card cooling assembly of claim 30, wherein said spring contacts comprise lithographic springs.

33. A probe card cooling assembly, comprising:

means for sealing at least one die with active electronic components in a package; and

means for circulating coolant through the package during operation of the active electronic components in testing to reduce thermal variations across each die.

34. A probe card cooling assembly for use in a test system, comprising:  
probe elements; and  
a package coupled to the probe elements, wherein the package includes  
at least one die with active electronic components that are directly cooled by  
coolant during a testing operation.